# The Dark Universe

## *Origin and evolution*

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## 1. Introduction

The granular hypothesis [1] is the main premise of my new model of the universe – a complete set of principles and explanations that can help decipher the secrets of our universe while showing exactly how it evolved and expanded over time. As the Prime Theory already stated [1], the evolution of the universe and the evolution of space are identical things: space and its characteristics are entirely responsible for the emergence of matter, for all its transformations, as well as for all the interactions exerted by different fields – actually known as "the laws of physics". Inevitably, two very important questions will come up right away:

Q1. Where is space coming from?

Q2. Are the laws of physics universal, valid anywhere in space and time during the evolution of the universe?

The answers to both questions require a clearer definition of the concept of *time*. Is this physical quantity a sort of abstract quantity, unrelated to concrete matter, flowing at a constant speed and in a single direction - from the past to the future? Or is this an internal characteristic of matter, a result of its intrinsic kinetics and its specific constants, which have no meaning if seen separately? All the tests and experiments have proven so far an inextricable link between time and matter; furthermore, the rate at which time passes depends on the speed of matter (of physical bodies) and on its gravitational field (a term that is commonly used is "spacetime warping", but Prime Theory [1] had introduced the expression "uneven distribution of granular fluxes"). Things went even further in Gravity [3], where time – in all its valences and at any dimensional scale – was directly associated with the motion of matter observed from an absolute frame of reference (AFR). And we mean by matter any compact granular formation or structure that is relatively stable – from an elementary particle to the largest celestial bodies.

*Answer 1*. Basically, the spatial fluid causes and maintains, through its granular fluxes, the stability of any material structure, at any scale. The emergence of this granular fluid effectively coincides with the emergence of space, and several variants of the origin of space have already been introduced in [1] and [3]. This granular fluid will then pass through several stages of self-organization, while the empty space (which is presumed to have a boundary) it occupies is continuously expanded. This leads to a point where all elementary particles are created. After a cooling period, these particles combine and form new structures: the Hydrogen and Helium atoms; moreover, the atoms are immediately emitting their first photons, omnidirectionally, which subsequently decouple from the structured matter and constitute the well-known Cosmic Microwave Background Radiation (CMBR). At this moment, a set of additional laws must be issued in order to include those complex new structures the elementary particles (atoms and molecules) will build – **The Laws of Physics**. However, the simple laws of granular motion [1] are the fundamental rules that underlie any law of physics, at both micro and macroscopic levels. They are also the basis of the global relativism of the universe, i.e. they ensure the invariance of the laws of physics to the position in universe, to time and uniform motion, but they also give us the general laws of conservation of energy and momentum; moreover, all these "principles of operation" must be formulated adequately, to work in any epoch of our dynamic and expanding universe!

*Answer 2*. In addition to the Prime Theory's [1] postulates and laws related to the granular matter, one more principle will be introduced now, the "*Universal Postulate*" (UP); it will ensure that any law applicable to the structured matter will be invariant throughout the universe:

***The laws of physics are invariant to the changes in spatial density.***

Clarifications:

- the postulate covers a wide range of granular densities, starting from the high level at the time of CMBR emission to today's level, at least, and assumes that all fundamental characteristics of matter and fields do vary simultaneously and linearly. This statement is based on a simple logical inference: as long as the fields and the constituents of matter have a common origin, i.e. the granular fluxes, it seems normal that all fundamental physical quantities change simultaneously and evenly when the intensity of these fluxes changes.
- if the granular density changes uniformly in a region of local absolute, the state of that region will not change. However, if the changes cause some density gradients, the laws of physics and the units of measurement must be adapted accordingly.
- the granular density is proportional to the intensity of local granular fluxes (if they are uniform and omnidirectional).
- the space regions where matter is very dense (massive celestial bodies) feature a significant unevenness of the local fluxes (commonly known as "gravity" or "curvature of space-time"); for these regions, the laws of physics must be adapted accordingly (similar to Einstein's General Relativity approach, but based on the new paradigm).
- this multiple invariances of the physical laws (to position, time, uniform motion and granular density) completes the global relativism that characterizes our universe and helps us decipher all of its cosmic-scale secrets, being supported by today's very precise astronomical measurements.
- with all this invariance of the laws of physics, the units of measurement cannot remain unchanged in all cases! The physical quantities are keeping their known correlations (force will be mass times acceleration anywhere in the universe), but the units of measurement will practically become variables if seen from an absolute and comparative perspective. Let's take,

for example, the speed of light, a physical quantity that has been declared a universal constant; its absolute value, if viewed comparatively, will differ in different places and at different times throughout the universe! Measured with the same device, its value could be $3x10^8$ m/s anywhere within our universe, but its absolute value may differ significantly (and this thing cannot be perceived directly due to the global relativism; also, the changes are relevant only between very distant cosmic zones). Similarly, two identical objects of mass 1kg, one on Earth and one on another planet, could have different absolute masses (the paradox of generalized relativism deepens when those two masses cannot be compared directly!). Anyway, if we bring the objects together, the masses will become identical – since the matter they are made of is self-adjusting to the local spatial density. In addition, a standard mass of 1kg placed in a rocket traveling at relativistic speeds has a greater absolute mass, but any local measurement cannot detect the difference! A comparative look over some essentially relative measures and over the universal laws governing the physical quantities can be taken, however, using several special techniques; for example, we may observe different galaxies and analyze the spectrum of light that comes from them.

All these premises helped me create a complete model for our universe (which will include its genesis and evolution) and formulate coherent explanations for every major event in its history; all these rational explanations and interpretations are based on a minimum set of principles and postulates, addressing many exotic notions and less coherent theories introduced by astrophysics - such as the cosmic inflation [5] and dark matter/energy.

## 2. An alternative to the Big Bang theory

The new distributed model of our universe's birth was described at length in Cap 1.6 of [3]; this model, along with some additional clarifications, presumes the existence of a finite amount of special, primordial matter (called essence) and its irreversible granularization at a given moment called *time zero* [2]. We are talking about a compressed volume of superfluid essence that is enclosed in a kind of external, indefinable environment; the essence is completely separate from this external medium - which may as well be a superfluid material. The granularization of this primordial matter could be explained in several ways, for example by the resonance phenomenon caused by mechanical waves or by a change in the pressure exerted by the external medium. Whatever the cause of these fluctuations, at least a region of perfectly empty space appeared somewhere in its volume at *time zero*; that void, regarded as a region of negative pressure, has triggered a chain reaction-type process of "vaporization" in which the essence *exposed* to the empty spaces turns into granules. The process continued until all the essence became granularized.

Given the super-fluidity of the essence, all detached "drops" already have the smallest possible size or will split very quickly to that size as a result of collisions; whatever the birth process would have been, the granules have gained a maximum absolute speed in the end and the total energy of the system is conserved (potential plus kinetic). When the whole mass of essence is "vaporized" and the granular fluid filled the newly created space, the pressure exerted upon the external membrane reaches a maximum value; consequently, the spatial bubble begins to expand at a very high speed, close to the absolute limit *C*. There is something to be noted, a particularity of my model: the collisions between granules and the external membrane cause the granular reflection process and, consequently, the continuous homogenization of the spatial fluid. These things are similar to the vacuum evaporation of a liquid in a closed chamber. If we assume that the chamber walls are infinitely elastic, the next phase (so-called *cosmic inflation*) will be easily understood: we are dealing with a fixed amount of granular fluid enclosed within a finite empty space that is continuously expanding. The granular fluid is directly affected by expansion, it will undergo a continuous decrease in density (its total number of granules is constant - Fundamental granular postulate #2 [1]). This expansion (two stages) will be analyzed further in greater detail to determine how it leads to a self-structuring process within the granular fluid.

However, why is this model better than the Big Bang theory and the current version of cosmological inflation? And which contradictions does it actually eliminate?

- First, it eliminates the need for that presumed singularity, an infinitesimal point of extreme temperature and extreme concentration of energy (!).

- All these simple assumptions also allow us to develop a new theory for gravitation, in which the gravitational granular fluxes constitute the source and the propagation medium for all the other fields.

- The general relativity and quantum mechanics are now reconciled, they both describe the "working mechanism" of our universe and reveal the common denominator of the laws of physics, namely the *granular mechanics*.

- *Cosmic inflation* is removed from the mechanism that shaped the early universe (anyway, it does not explain how the huge amount of "energy" stored by singularity has evenly spread over higher and higher distances during expansion);

- The hypothetical superluminal speed of the initial expansion may be explained (the radius of the primordial space bubble could increase at any speed below C in my model) if we see these things in absolute terms, from the emergent universe's rest frame (check the granular postulates [1]).

- We have now correctly defined the concept of energy, we now know where the energy comes from and what its form was during this period. The granular motion is completely chaotic, so that the granules move in all possible directions and thus "fill" any new region of empty space in no time. The granular density was really huge at first (it all practically started from one granule next to another), but decreases quite quickly over time. Consequently, the probability of multi-granular collisions also gradually decreases, while the first *directional granular fluxes* [1] are starting to flow. At the same time, granular formations with short lifespans emerge, move chaotically and then disappear (they were unstable). Subsequently, when the granular density reaches a certain threshold value, the directional fluxes become dominant and "push" some compact granular formations (now with longer lifespans) towards each other. As the density gradients are still high and can curve most granular fluxes, the emergence of many pseudo-stable rotating groups is imminent; this is actually the granular process that has built the first elementary particles, *the quarks.*

- A plausible hypothesis can now be formulated on how the first supermassive black holes have been formed. Let's assume the existence of a large mass of essence (in granular or compact form) somewhere in the early universe. The very intense fluxes that hit on the surface of this embryonic black hole will create the so-called "gravity"; all nearby particles will be pushed by these gravitational forces directly towards the embryo, being incorporated immediately. It is obvious that the mass of this black hole embryo will increase rapidly and, therefore, more granular material and particles will be attracted to it. In my opinion, the accretion of dense granular fluxes (which are curved in the vicinity of black hole embryos, pass their "event horizon" and then are incorporated into their body) is the main mechanism by which their mass grows so quickly in this short period – speaking, obviously, on a cosmic scale of durations (accretion will be balanced later by granular evaporation). The compact internal layers of the BH embryo rotate rapidly, even relativistically in some cases, and this creates a centrifugal force that is continuously balanced by the external granular pressure. Embryos of this kind could reach millions or even billions of solar masses, being evenly distributed throughout the granular fluid (due to the specific intensity of its fluxes); also, their translation speed is very small in regard to the AFR. Anyway, the mass of these types of BHs can be seen in the usual sense - as they all are made up of compacted granular layers. Known today as super massive black holes (SMBH), they play a particularly important role in the evolution of the universe, being in fact those stars around which the future galaxies are to be built (i.e. those cosmic bodies that can produce enough "pull" to ensure the galactic cohesion). The primordial gases are attracted by SMBH, increase in density and start to rotate while their angular momentum is conserved; over time, the process of accretion and the collapse of these vortexes trigger the ignition – and this is the moment when the very first stars were just born. Now, as the attraction is exerted at a stellar level, the newly formed stars began their revolution around the central BH on orbits where the pull balances out the centrifugal forces. This is the simplified mechanism that shows how a protogalaxy is built, and now it's very easy to observe the decisive role of the central SMBH in powering the whole process.

- As a result of the self-uniformization property of granular fluids, *space* cannot have any curvature, it is flat and does keep itself this way – although we presumed it has an outer boundary of spherical shape. Moreover, we may say that any point is continuously crossed by omnidirectional fluxes of equal intensity, and this makes space *homogeneous* and *isotropic*. The initial unevenness of its density (due to the combination of some initial waves) has led, most likely during this stage, to the emergence of SMBH in those particular, almost equally spaced places. These BHs are stationary stars, no additional forces are exerted on them while space expands and their initial linear momentum, if any, will remain almost unchanged. However, the reciprocal gravitational pull of SMBHs can change their speed over time and cause the formation of certain local groups, clusters or filaments.

The duration of this initial stage (considered to last until the CMBR was emitted) is estimated by the standard cosmological model of current physics at about 400,000 years; however, given the linear expansion of space presumed in my model, this duration could be significantly longer. Whatever the actual duration of Stage I would be (see the upper part of Figure 1), its timeline includes these important moments:

- First fluctuations within the primordial mass of essence and the distributed big bang.

- The density of the spatial fluid is decreasing as the volume it occupies increases.

- With this decrease in density, the simultaneous collisions between several granules or granular groups have gradually turned into individual collisions that preserve the linear motion; at this time, the rectilinear fluxes gradually became dominant and thus generated the most important phenomenon in the universe – the *Gravity*.

- Formation of elementary particles and the particle/antiparticle annihilations.

- The possible birth of SMBH embryos right at the end of this stage, when the granular density was still high and many compact structures could easily stick to them.

- The gradual cooling of this medium allowed the free particles to slow down and form the H/He atoms.

- The decoupling of photons from matter and the CMBR emission.

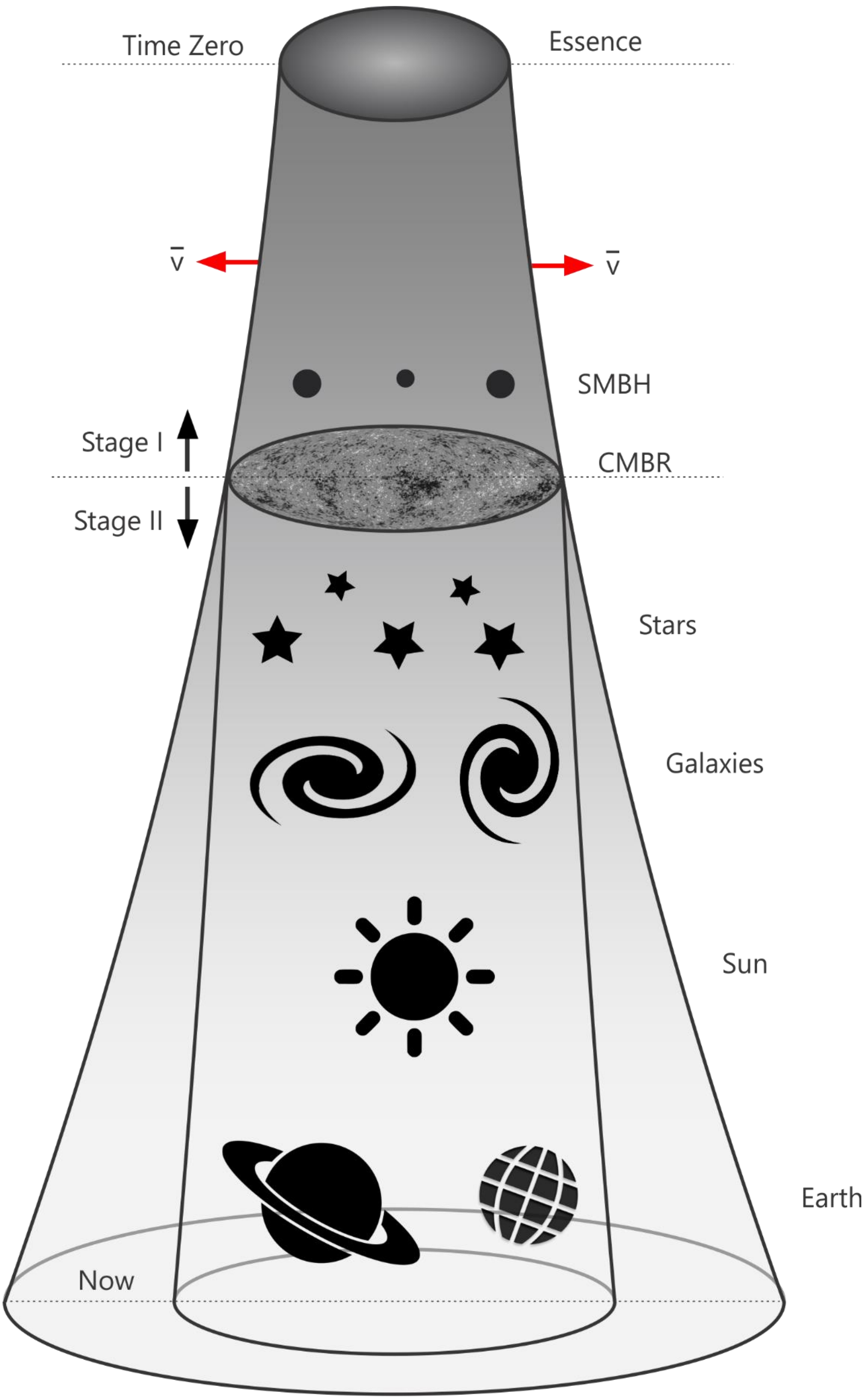
There were a few moments, such as the birth of elementary particles, the birth of black hole embryos and the particle/antiparticle annihilation (i.e. compact and stable granular structures with mass), when the average granular density of space varied significantly. However, these changes are not visible in the representation of spatial density (the shades of gray from Figure 1). It should also be mentioned that the global entropy, if space is seen as an isolated system, practically decreases at these particular moments (the order has increased, space became more organized). The reason for this paradox (which is only present in the special system named the "early universe") could be found in the strange behavior of the granular fluid: at certain granular densities, individual granules act differently from their groups, and this depends on the size of the group.

Also, we could infer that the homogeneity of the granular fluid, which is preserved during expansion through dispersion, has led to the uniform distribution of elementary particles and, subsequently, of gaseous matter (H and He).

The speed at which space can expand is, obviously, lower than the absolute granular speed, $v \leq C$; although this speed might depend on the granular density (similarly to the pressure of a gas, which depends on density), we will further use the constant value $C$ for this speed, $v = C$.

But why does the granular density of space continue to decrease, as all the fluxes became directional and their structure is assumed to be *fixed*? The explanation – valid for any region of *free* absolute space - is based on two direct implications of expansion:

- As the potential distance traveled by fluxes from one edge of the space bubble to another is continuously increasing, the average time after which they are reflected back and might cross again the considered region increases proportionally to the expansion speed.
- The average distance between all the granules of a flux increases after reflection, also proportionally to the expansion speed. Therefore, a weaker reflected flux that crosses the considered region will lower the local density of space.



Time Zero
Essence
$\bar{v}$
$\bar{v}$
SMBH
Stage I
CMBR
Stage II
Stars
Galaxies
Sun
Earth
Now


**Figure 1**

## 3. Global and local evolution

Once the primordial "soup" has cooled sufficiently at the end of the first stage, the remained elementary particles (those electrons and protons not annihilated by their antiparticles) were able to form the first hydrogen atoms and thus photons were no longer scattered (H and He are transparent gases). Therefore, the radiation emitted virtually from every point of the early universe (which had a temperature of about 3000K), could propagate in a straight line in all directions. This cosmic radiation is known by the acronym CMBR and its well-defined spectrum (whose point of maximum is in the microwave range and whose uniformity is very high, 1:100000) has a redshift $z$ [6] of about 1100. Since this radiation has the same intensity in every direction, the frame in which its isotropy is the highest can be used as AFR within the local region of absolute, and, after certain corrections, for the entire universe.

Stage II of the global evolution begins just after the CMBR emission; the expansion of space continues, but the newly created structures of matter (from tiny particles up to the stars) are not engaged in this process, as there are no forces exerted on them. The so-called inflation only affects the granular level of space and does not generate any force fields. Present in every place, the expansion process represents only a continuous "dilution" of the granular fluid – as it occupies a space that is continuously increasing in volume – and this may be quantified by the density's scalar field. The "working mechanism" of matter does not change over time (see Chapter 1 above), only the ratio of the local absolute "constants" to some reference values is changing – and this may affect the units of measurement. Consequently, the physical quantities may have significantly different measures, but the correlations between them will be the same; anyway, there are real changes, the matter is really changing, but we cannot perceive this locally as the global relativism of the universe prevails. Obviously, in order to simplify things, we may declare the current units of the International System as absolute and use them as references in any comparative analyses. All components of our universe are connected and they evolve together; however, there is a certain *locality* manifested within and around each massive component, and this changes the absolute physical properties of its material structures.

## 4. The redshift

Let's consider a hypothetical three-dimensional grid that overlaps the rest frame of our universe (AFR), having the step of one meter on all axes. We also assume that the universe does not rotate and its intrinsic absolute may be perfectly observable from this fixed grid. The Meter is the current unit of measurement for lengths, i.e. the distance traveled by light in a vacuum in 1/299792458 of a second. From now on, the current units of space, time and speed will have an absolute nature and will be used to compare and explain some of the latest astronomical measurements (light and other radiations coming from distant cosmic objects). Due to the finite speed of photons and particles, we are actually immersing into the past of the universe and observe some cosmic events that have already happened. Anyway, we must add to our analysis the two important assumptions described above, the invariance of the laws of physics over time (UP) and the continuous expansion of space. All of these will be applied on a balloon-like universe whose outer membrane continuously stretches at the speed $v$, $v \le C$; for simplicity, the radius of this sphere increases *linearly* with that speed $v$. The volume of space will thus increase with the cube of the radius, while the density of its granular component decreases in the same proportion (uniformly, any inner point being reached at the local speed of light). These density variations do not change the laws of physics (see the UP), but the speed of light will be changed in absolute terms. The formula for this speed is known from [1]:

$$v = C / (1 + \rho \tau C)$$

**C** - absolute granular speed, a constant
**v** - current speed of photons
**ρ** - linear granular density, includes the collision probability
**τ** - average duration of a granular collision

What happens to the universe's organized matter, i.e. to the ordinary stars, SMBHs and galaxies that were formed after CMBR? Does the spatial granular fluid have a gradient of density caused by the geometric expansion of space, i.e. a lower value of density in its peripheral regions? My answer is affirmative, there is a small gradient, but it may be ignored if we consider the huge scale of the universe. As this gradient cannot produce significant forces onto the cosmic formations, we will further consider that space is a homogenous and isotropic medium. Unless we take into account their low linear speed and their eventual rotation in the local clusters, galaxies can be regarded as **stationary** in their filaments and thus in our fixed grid (AFR). Basically, the standard model sees the expansion as a continuous *increase* of the intergalactic distances over time, this being resulted from a quantitative analysis of the redshift of light coming from distant galaxies. Some recent observations have indeed shown that the recessional speed *v* is proportional ($v = H_0D$) to the proper distance D (distance to that galaxy at the time of emission multiplied by a number, 1+z) by factor $\mathbf{H_0}$ (the Hubble constant, estimated to be 67.4 ± 0.5 km/s/Mpc).

But what does this expansion actually mean, this recession of galaxies from us and implicitly one from another? Does the above mathematical formula imply any real movements or we are dealing only with apparent displacements? And how can we accept that space itself is "stretching", as long as the special "material" it is made of is not defined by the "standard model" of current cosmology? Moreover, does this kind of space expansion manifest selectively, only outside galaxies, or it happens everywhere?

To answer these questions, let's now consider two galaxies very far apart, denoted A and B (and by B we understand Milky Way and an observer from Earth). The photons emitted from A one billion years after CMBR have crossed the intergalactic space for about 13 billion years and just arrived on Earth, where they are found to be significantly redshifted. How can we explain this in a granular context, using the photon model described in Chapter 13, [3]? How did the space between those stationary galaxies actually increase over time?

Additional assumptions for my new analysis:

1. The total number of granules in the universe is *constant* (Fundamental granular postulate #2, [1])
2. The granular structure of photons is *fixed*; however, it may be changed in regions of very high density gradients or after some collisions with the matter.
3. Considering the global relativism and the UP conditions, we may infer that any variation of spatial density will not change the laws of physics at the local level. As the most "visible" thing that differs throughout space is the speed of light, we may also assume that other related physical quantities will differ in the same proportion.
4. If we admit this last idea and presume in addition that the *local distances are absolute,* we can draw an interesting conclusion: *the local time flows at a rate that is proportional to the speed at which light travels in that spatial region* (a measurement made with the light clock would confirm this conclusion, see the Chapter 8.6 [3]).

5. The Doppler effect caused by the motion of either the light source or the observer will be ignored in the case of these photons, as will the shift caused by the gravitational fields to their spectrum.

During its long journey to Earth, a photon emitted from galaxy A (of frequency $f_A = v_A / \lambda_A$) passes through increasingly older regions of the universe and crosses a more and more diluted space (see Figure 2). The speed of this photon is the only parameter that changes in the process; any spatial density gradient would exist along the path, its effect would be negligible over short, wavelength-size distances and could not cause any significant redshift. Similarly, photons are not redshifted if scattered by particles and transparent cosmic gases. A photon that collides with a cosmic Hydrogen atom, for example, would have the same structure (same $\lambda_A$) but a higher local speed, $v_H$; therefore, the apparent frequency "read" by the atom would also be higher. As assumed above (#4), we may say that the local time flows as fast as the light does, so the Hydrogen atom will read exactly the initial frequency, $f_A$. The wavelength $\lambda_H$ of a re-emitted photon will be identical with $\lambda_A$, and this phenomenon repeats on any further photon - atom/particle interaction. Therefore, the photon received in galaxy B has the same structure as the photon emitted from galaxy A (same wavelength $\lambda_A = \lambda_H = \lambda_B$), but a higher speed ($v_A < v_H < v_B$). This normally means a higher frequency ($f_B = v_B / \lambda_A$), but we should consider the source's local time: as it has flown slower in the same proportion, the received frequency will be *equal* in fact to the B's *local* frequency ($f_B = f_{A0}$). Basically, the light that arrived on Earth has the same absolute spectrum as the light emitted from galaxy A, and this means that the photons were already redshifted at the source.

We may calculate the redshift *z* using the following formula:

$$1 + z = f_{real} / f_{received} = f_{real} / f_B$$

in which $f_{real}$ is the actual frequency of light emitted by a nearby galaxy ($z = 0$, we could check the well-known spectral line of a chemical element, the red line of Hydrogen for example).

Conclusions on the new analysis of redshifted photons:

1. With all their speed difference, photons have the same relative frequency in both galaxies. The redshift of photons coming from distant galaxies is therefore only a reflection of the respective galaxy's specific physical quantities at the time of emission. In fact, the value of this redshift quantifies the difference between our today's universe and a frozen image from its past.
2. As we already assumed above, galaxies are quasi-stationary objects in our absolute grid (which overlaps the CMBR's rest frame); they are not moving away from us, the distance between them does not increase. Over time, with the decrease of spatial density, the speed of light increases and, consequently, the related physical quantities will also change. As the rate of local time is affected, the *frequencies* of photons emitted by the chemical elements (also by the universe's black body, CMBR) became relative to the local space, as well as their energies.
3. The redshift of light does no longer provide information about the *recessional velocity* of galaxies (or about the so-called expansion of space that would produce a similar Doppler effect). Now, in case we know the rate at which the density of space is linearly decreasing, we may deduce from *z* the exact age of the galaxy A at the time of emission. Obviously, things are more complex and the redshift depends on several variables (the size of galaxy A - which determines its average granular density – or its speed /direction of travel in regard to the CMBR's rest frame). However, the distance to a galaxy can still be calculated from the brightness of light emitted by some of their stars (Type 1a supernovae may be considered

cosmic candles) - but this will also depend on the model used to determine the variable speed of light.

4. The universe is expanding, but only in a geometric manner; the volume of space grows bigger and bigger while its granular density decreases evenly. As most galaxies move at very low speeds, we could characterize their part of the universe as *static*. The linear density is a function of time and can be written as follows (the space bubble is linearly increasing in diameter with the maximum speed 2C in my simple model):

$$\rho(t) = N/\ (D_0 + 2Ct)$$

$D_0$ – the diameter of the spatial sphere at CMBR time (t = 0)
N – the virtual number of granules on one axis
C – the absolute granular speed

The distance traveled by photons from galaxy A to B can be expressed as follows (we cannot talk about proper distances now, when space is no longer expanding effectively):

$$S = \int_{t1}^{t2} \frac{C\,dt}{1 + \frac{N\tau C}{D_0 + 2Ct}}$$

If K = N C (K is a length-type constant), $D_1 = D_0 + 2Ct_1$ and respectively $D_2 = D_0 + 2Ct_2$ (the diameters of the spatial sphere at two different moments), the integration by parts gives us this solution:

$$S = \frac{1}{2}\ (D_2 - D_1 - k \ln \frac{D_2 + k}{D_1 + k})$$

*Remark 1.* If space would expand slower, with the new speed *v*, *v* < *C*, the absolute speed *C* must be replaced with *v* only in the formulas for the two diameters, $D_1$ and $D_2$.
*Remark 2.* If we consider $t_1$ as being the time when CMB was emitted ($t_1 = 0$), the distance travelled by radiation as function of time can be written:

$$S_{CMBR} = \frac{1}{2}\ (2Ct_2 - k \ln \frac{D_0\ +\ 2Ct_2 + k}{D_0 + k})$$

5. A new standard model should no longer include the gravitational "pull" exerted by matter and the so-called dynamic balance maintained by the current inflationary model's dark things. Space's change in granularity and its increasing volume are the only fundamental phenomena to be considered, and they are now almost independent of the "turbulence" of structured matter; however, the granular density of space and the absolute mass of matter will always depend on each other and thus the laws of physics will be continuously "adjusted" by the local space (this is the global relativism of our universe). Practically, galaxies do not move away from each other, but slowly rotate and translate with hundreds of km/s inside the "sphere" where they were born (projection of that sphere on the time axis is a cylinder, check Figure 1). For instance, our Milky Way galaxy is moving at about 630km/s relative to the cosmic background, while the speed of Andromeda with respect to us is about - 125km/s (both galaxies are approaching one another).

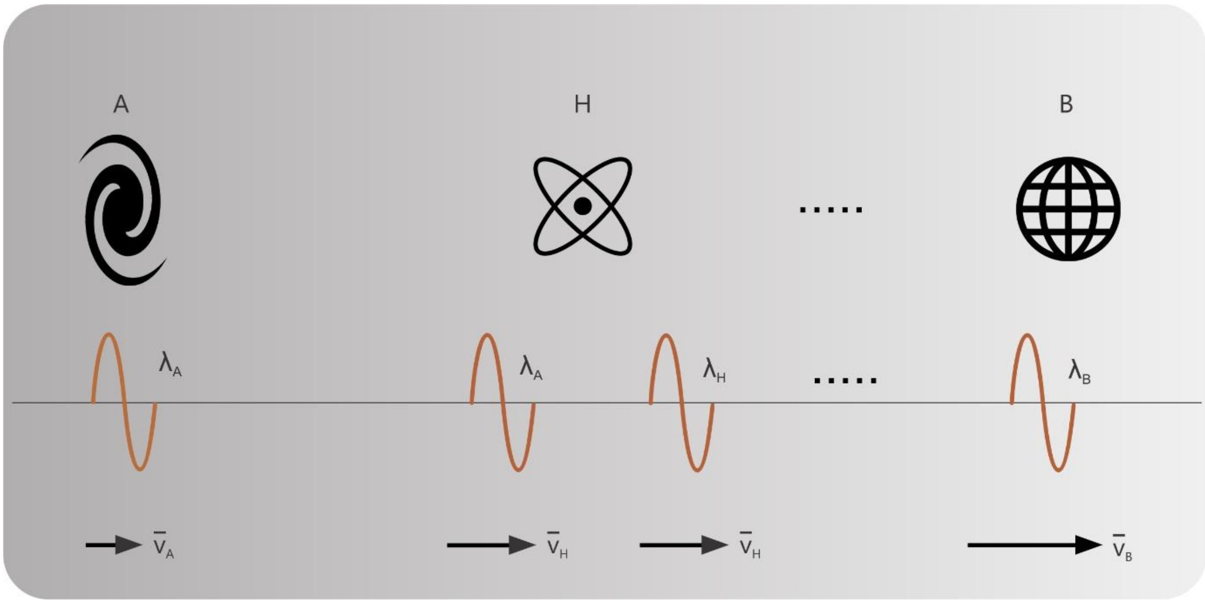



**Figure 2**

6. The equation involving the Hubble constant has no longer any meaning, it could be replaced by a simple correlation between the age of the galaxy (or the speed of light) and *z*. Analyzing the redshift *z* for several distant galaxies and considering the ages given by the standard cosmological model, we see a relation of proportionality between speed and time, starting 13 billion years ago, from about 38,000 km/s to 300,000 km/s today. A steeper, non-linear increase occurred in the beginning, during the first 800 million years after the CMBR event (when the value of *z* decreases from 1089 to 7).
7. One might say that we used the absoluteness of local distances to demonstrate the global absolute, using a kind of circular logic within the previously assumed relativism of the entire universe. However, since the speed of light and time are related quantities – as the variable granular structure of space limits both the speed of light and the speed of matter (which sets the rate of time) – this choice becomes perfectly reasonable. Of course, it is somewhat paradoxical how space, a fluid that dilutes itself as time passes and whose variable density affects matter, maintains the distance between all cosmic structures and also keeps their sizes at a virtually constant geometric scale.

*This model improves the previous interpretation of the redshift (10.2.2, [3]).*

## 5. Dark Things

### 5.1. Photons and space

All photons have a fixed shape and travel through space at the local speed of light [1]. In other words, a photon is a particular granular flux that holds its shape and direction of propagation unchanged when crosses a homogenous spatial region. There are, however, regions of space where some parameters of photons (or of any flux) might change:

1. A region with a dominant perpendicular flux (on the tangent to the star's surface)
2. A region that has a certain gradient of granular density (approaching a massive cosmic body, such as a star)
3. A region where the gradient of density forms a certain angle with the path

*Case 1:* A photon passes through a perpendicular gravitational flux, as shown in Figure 3. If there would be a region of uniform fluxes, the collisions between the photon's constituent granules and those of the homogenous spatial fluid will have no impact on its trajectory. A dominant flux, however, causes a greater number of collisions in a given direction, which in our case would mean a non-zero displacement of the photon trajectory, $\Delta x$. This displacement is proportional to the intensity of the flux $\Phi$, the granular speed C and the collision time $\tau$ (TGR would name this the curvature of space-time caused by gravitation):

$$\Delta x = k_2 \, \Phi \, \tau \, C \sin \alpha$$

*Note 1:* Whatever would be the direction of the dominant flux (which can be viewed as a resultant of all local fluxes), the spatial orientation of the photon does not change. The displacement only alters its trajectory (curves it towards the source of gravity) and its speed (a little); furthermore, if this photon exits the gravitational field, i.e. the region of dominant flux, it will resume its initial direction of travel. Depending on the angle $\alpha$, that displacement is:

$$\alpha = \pm 90°\text{:}\ \ \Delta x = \text{maximum}$$

$$\alpha = 0° \text{ or } 180°\text{:}\ \ \Delta x = 0$$

*Note 2:* Near the event horizon of a black hole, in a region of very intense gravity, photons can be "dragged" inward faster than they can move outward. Depending on position and direction, photons may be absorbed by the BH or they may continue the journey on a different trajectory.

*Case 2:* If photons cross a region with an extremely high gradient of granular density (a BH of small dimensions), an additional change in their wavelength can be caused by the different speeds of their component granules along the direction of travel.

*Case 3:* In this case, a change in the granular density of space modifies the speed of light in that region, which automatically leads to a change of all local physical quantities. As photons travel at a lower speed in the denser medium, their trajectory will change; this is perfectly similar to the *refraction of light,* a phenomenon that occurs when light enters a material with a non-unitary refractive index.

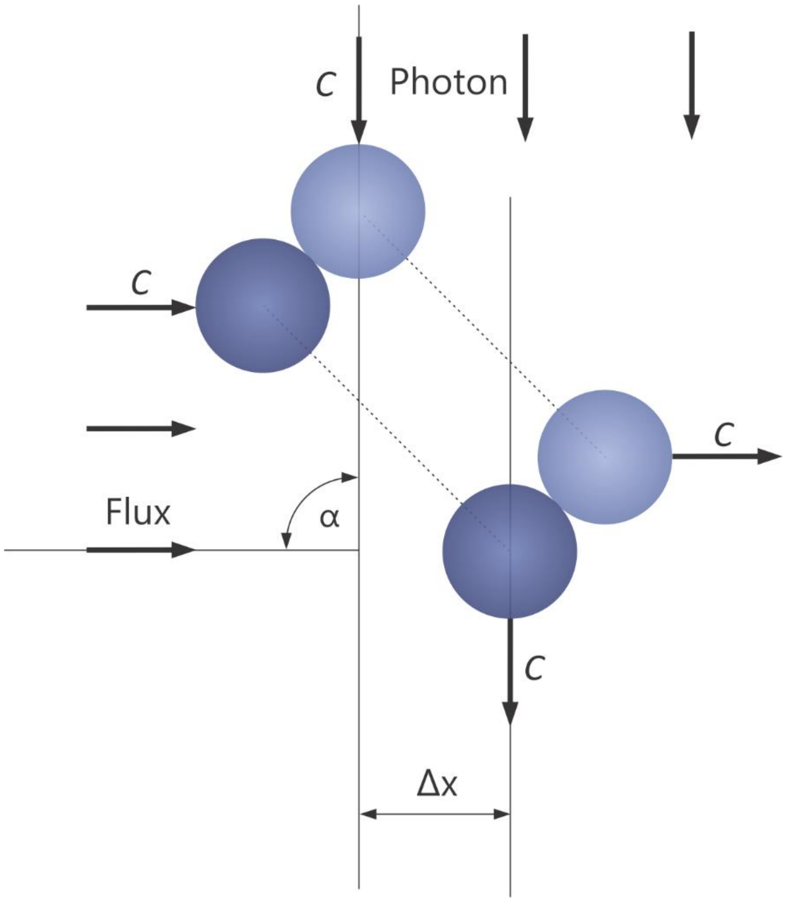



**Figure 3**

### 5.2. Dark matter

One important problem of modern cosmology is the motion of stars in the peripheral regions of most galaxies, specifically their rotational speeds. Scientists should offer better explanations for their higher speeds and tell us the reason why those stars were not ejected into space. Basically, a greater gravitational force appears to be exerted in that regions than in the rest of a galaxy. Many attempts have been made to develop theories and models – such as a modified Newtonian dynamics (MOND) on large distances or a new type of matter that interacts only gravitationally (Dark Matter) – but the mystery has not yet been unraveled. This latter theory was more successful due to an observational confirmation: the presence of so-called dark matter was indirectly confirmed by the light-bending effect in the galactic zones. However, the detection of a "cold" particle (so is not the neutrinos) that would constitute this matter does not yet have an experimental confirmation.

But how can we explain "dark matter" in the new context of granular mechanics, knowing that the Universal Postulate from Chapter 1 also applies inside galaxies? Moreover, any explanation would be given now, it must also apply to the rotation of the large clusters of galaxies (which have the same speed "problem").

To formulate the answer to this question, another observation must be made: regardless of its concrete structure, the matter is in a permanent state of equilibrium with the spatial fluid in which it "floats". Thus, the granular pressure dictates, among other things, the size and mass of all particles, the intensity of all fields and even the speed of photons. As space is continuously expanding and its density decreases over time, we may say that the net result of granular transfers is now in favor of space, there is a permanent granular migration *from matter to space.* In other words, any cosmic formation (galaxies included) is "emitting" a weak granular flux around – a flux that causes a small increase in density to the adjacent space. Any galaxy will therefore develop a granular "halo" which is slightly denser than the free space. Let's see how dense is this halo and whether its properties are identical to those of dark matter.

As a continuation of the simple logical inference that led to the idea of granular transfers, let's examine now the influence of gravitational fields onto this special region that seems to surround matter anywhere in our universe. In a classical approach, at a certain point located inside or in the vicinity of a spiral galaxy, the gravitational field is a resultant of the fields generated by every star, by the central SMBH and by the cosmic dust and gases (notice their big delays over the intragalactic distances – from a few light years up to hundreds of thousands of years). At a lower dimensional level, the fluctuations of these fields create regions of local absolute – overlapped or separated – that surround all cosmic entities and form a "galactic absolute". However, at the lowest level of all - the granular one – we may observe how most of the local fluxes are reflected and scattered *repeatedly* by stars and interstellar gases, being permanently replaced by the external ones. This repetitive process, in which the local fluxes swing back and forth for a while (before they go back into the cosmic void), causes an increase of local granular density and leads to a certain state of *balance*. Therefore, the higher density of local space will significantly slow down the new fluxes that enter the galaxy. This region of higher density actually overlaps that halo described above – which may now be identified with the dark matter – and will permanently surround any type of matter included in a galactic structure (Figure 4). As it was postulated in Chapter 1 (UP), this halo does not change the local laws of physics - only the absolute measures of most physical quantities will differ; anyway, this particular statement can only be proven by comparative methods.

Is this concrete halo helping us explain the various astronomical observations that led to the abstract concept of dark matter?

*Explanation 1.* The higher density of a halo, which also means increased gravity, bends the trajectory of photons in two ways: if the density changes - by refraction (as in Case 3 described in Chapter 4.1), and if the gravitational field is strong - classically (as in Case 1). Thus, by using these galactic-sized telescopes – whose lens are made of dark matter – we can observe the stars and the cosmic formations hidden far behind galaxies (see Figure 4).

*Explanation 2.* A spiral galaxy, such as the one depicted in Figure 4, is surrounded by dark matter. It is natural to assume that this halo would be denser in regions with massive stars and denser gases. Consequently, a density gradient will appear within this granular matter, from the galactic center (high density, dark gray) to all peripheral zones (light gray), along the spiral arms. Over short distances, such as a few light minutes, the difference is negligible; over long distances (light years), however, the difference becomes significant and can produce visible effects. The formulas of universal attraction and for centrifugal forces, applied to the rotation of peripheral stars about the galactic center, must be somehow changed. As we have shown above (UP), the changes do not modify these two laws, only the measures of some physical quantities will be involved (as their absolute values are depending on the local granular density).

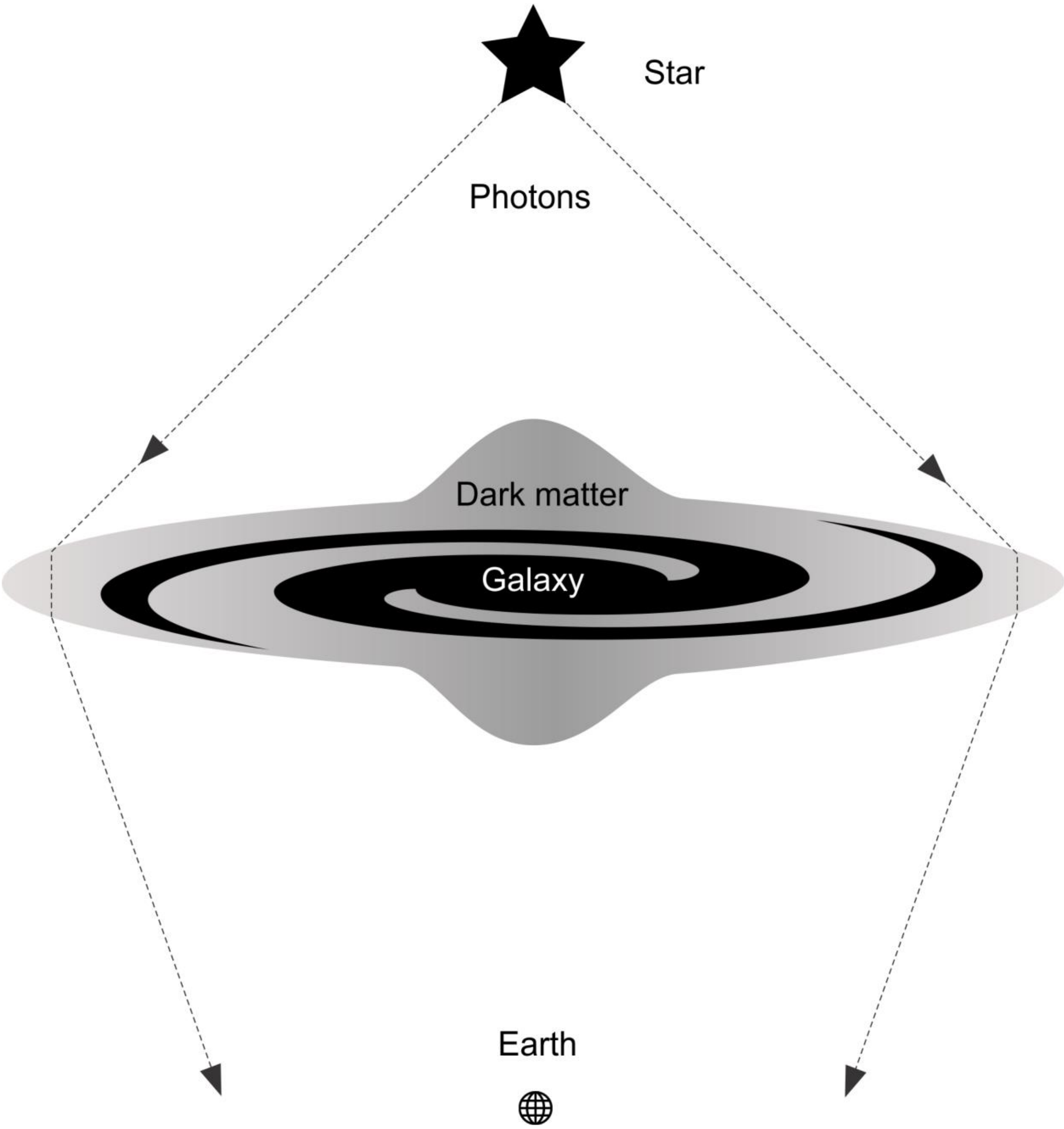



**Figure 4**

Let be a star (of mass $m_0$) that rotates at distance *r* about the galactic center (of a hypothetical mass m), in a homogenous region of space. Its rotational speed may be calculated if we equate the force of attraction and the centrifugal one:

$$G\, m_0\, m/r^2 = m_0\, v^2/r$$

$$v = \sqrt{\frac{G\, m}{r}}$$

However, the denser dark matter from the galactic center causes a stronger gravitational field; the actual mass that would produce that field is proportionally bigger, namely M. Therefore, the actual speed of the star will also be higher (v from the following formula):

$$\frac{v_r}{v} = \sqrt{\frac{M}{m}}$$

This ratio is, in turn, proportional to the density ratio between the two galactic regions and shows us that the rotational speed of peripheral stars is inversely proportional to the local density. This dependency is actually more complicated, being affected by many factors: the dispersion and size of the stars, the location of gases and cosmic dust, the retarded gravity, etc. The linearity and magnitude of velocities in a galaxy are thus justified by the changes of physical quantities in the presence of dark matter – whose density ultimately depends on the *distribution of galactic mass*. This phenomenon can have another, strange interpretation, namely that the laws of physics are changing over long distances! And here comes the "success" of some theories and models like MOND [4], which presume the modification of Newtonian mechanics in these particular situations and even give us some applicable mathematical formulas; however, they do not actually take the physical reality into account and the real phenomena hidden behind formulas are not explained.

*Explanation 3.* The regions dominated by dark matter extend to star clusters and filaments, which are similarly "connected" through this special type of "matter". The rapid rotation of some clusters may be simply justified by the existence of a greater gravitational pull in the presence of dark matter. We may say that matter is organizing itself on a larger scale (cosmic one), creating a dynamic balance in which the groups of galaxies maintain their distancing and tend to remain together in the larger cosmic structures where they belong.

### 5.3. Dark energy

If we consider its expansionist characteristic, the dark energy can be easily identified as space itself – a special granular fluid that had created all the matter and maintained it stable through the action of gravitational fluxes. Since these fluxes are omnidirectional and evenly distributed, our expanding universe must have boundaries (fluxes do return from the edges) and no internal curvature, while its number of granules must be constant (Law 1 of [1]). Moreover, as stated in Chapter 2, its expansion no longer involves the matter and formations that emerged after the CMBR event; in fact, space does not expand at all, it merely "dilutes" – i.e. its granular density decreases while its geometric volume grows (as a balloon made of an elastic material and filled with gas - it will dilate and the internal pressure will decrease). We concluded that the material part is quasi-stationary now and the expansion process affects only the local metric, keeping the laws of physics unchanged. The parallel made between the inflationary model and that raisin cake is no longer valid; in my model, the heated dough still grows - but the raisins are no longer moving along with it, they remain practically in their initial positions.

The redshift of light coming from distant galaxies can now give us an insight into their age, while a model for the density of space (or for the speed of light) would help us find how far they are. The radius of the observable universe would then depend on how big the universe was in the beginning (when the CMBR event occurred) and on how the speed of light has increased. Paradoxically, this quasi-stationary model would allow us to look even deeper into the universe with time – and not the other way around, as in the standard cosmological model.

A few additional ideas:

1. Space is not infinite and yet it is flat. Regardless of its "outer" shape, we cannot assign it a "center" – its perfect homogeneity and our limited observation (due to the speed of light) prevent us from doing so.
2. If space will continue to expand, its granular component will dilute and the intensity of gravitational fluxes may reach a minimum value from which they can no longer hold the cosmic formations and matter stable. Universe, as we know it, will disappear "in silence". About a possible subsequent contraction of space and a new big bang, we cannot speculate at this time.
3. The dark energy dilutes itself, as seen above, and the intensity of granular fluxes decreases globally. This is the real, causal link that exists between dark energy and gravity, and not a hypothetical balance between two different, independent force fields.
4. A cosmic balance is still maintained, and, even if the dark energy does not "oppose" directly to gravity, we cannot say whether the gravity "will win" or not in our universe. This dynamic balance, which is actually between gravity and inertia (as their intensity decreases proportionally), had existed since the first material structures have formed. Moreover, as the mass distribution causes gradients in the surrounding dark matter, this process became stable and the intergalactic coupling is continuously preserved.
5. Photons, neutrinos and the granular accretion of BH were not considered among the factors that could significantly affect the granular density of space.

## 6. Conclusion

An interesting link between the smallest particles and the largest structures existing in our universe has been identified here. We also saw how granular mechanics transfers its rules to higher dimensional levels, establishes the laws of physics and how it allows matter to self-organize and create increasingly larger cosmic formations. In addition, more light has been shed on those "dark" things and on how space ensures the stability of all structured matter. Even if space goes through a continuous process of dilution, the cosmic formations are almost motionless and show us a quasi-stationary universe that possesses an internal balance ever since it was born. The speed of light, whose finite value increases as the universe ages, offers us a unique view into the distant past and allows us to witness the creative struggle of matter from the beginning of time.

## 7. References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*Acronyms and conventions*

**CMB, CMBR** - Cosmic Microwave Background Radiation

**Big Bang** - Theory on the birth of the universe

**AFR** - Absolute Frame of Reference

**IFR** - Inertial Frame of Reference

**FR** - Frame of Reference

**TR** - Theory of Relativity

**GTR** - General Theory of Relativity

**TA** - Theory of the Absolute

**PT** - Prime Theory

**BH** - Black Hole

**SMBH** - Super Massive Black Hole

**"abc"** - Figurative sense